Information Technology Laboratory

Putting IT to Work for Our Customers

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Information Technology Laboratory

ERDC
Engineer Research and Development Center

Information Technology Laboratory

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Organization

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┌──────────────────────────┐
│  DoD HPC Major Shared    │
│     Resource Center      │
└──────────────────────────┘

┌──────────────────────────┐      ┌─────────────────────────────┐      ┌──────────────────────────┐
│  CADD/GIS Technology     │      │  Information Technology     │      │  Office of Technical     │
│  Center for Facilities,  │      │       Laboratory            │      │      Directors           │
│  Infrastructure, and     │      │                             │      └──────────────────────────┘
│     Environment          │      │     Executive Office        │      ┌──────────────────────────┐
├──────────────────────────┤      └─────────────────────────────┘      │     Management           │
│  CEEIS Program           │                                           │  Integration Office      │
│  Management Office       │                                           └──────────────────────────┘
└──────────────────────────┘
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| Central Processing Center | Engineering and Informatic Systems Division | Infostructure and Knowledge Management Division | Information Assurance Team |

| Western Processing Center | Computational Science and Engineering | Computer Systems Branch | |

| | Data Acquisition and Integration Branch | Communications Infrastructure and Architecture Branch | Information and Knowledge Sciences Branch |

| | Software Engineering and Evaluation Branch | Multimedia Presentation Branch | |

| | Automated Measurements and Analysis Branch | Publishing and Technology Transfer Branch | |

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ITL Centers of Excellence

CADD/GIS Technology Center for

Facilities, Infrastructure, and

Environment

Corps of Engineers Enterprise

Infrastructure Services (CEEIS)

DoD HPC Major Shared Resource

Center (MSRC)

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Distributed Workforce

Pooling c... redundan... responsiv... able,

Organization	Total Staff
Infostructure and Knowledge Management Division	176
Engineering and Informatic Systems Division	98
CADD/GIS Technology Center for Facilities, Infrastructure, and Environment	23
ERDC High Performance Computing Major Shared Resource Center (MSRC)	81
Corps of Engineers Enterprise Infrastructure Services (CEEIS)	63
Totals	**441**

andria, VA

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People Are Key to Success

- Total Advanced Degrees

  Masters   67
  PhDs   11

- Pursuing Advanced Degrees

  Masters   11
  PhDs   9

- Disciplines

  – Computer Science

  – Computational Science and Engineering

  – Information Science

  – Software and Electrical Engineering

  – Mathematics

  – Statistics

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Jamie L. Whitten Building

*ITL Headquarters
Vicksburg, MS*

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Our Technology Landscape Is Changing Fast

- Computing Power
  - Power doubling every 18 months
  - Scaleable and economical (PCs and servers)

- Data Storage
  - Worldwide digital data storage capacity doubles every 9 months
  - Estimated 4,200 terabytes of Web content

- Connectivity
  - Low-cost, high-speed Internet, wireless connections to employees, partners, and customers

- Device Proliferation
  - Smart devices - handhelds, PDAs, cell phones

- Emerging Standards
  - Open standards for exchanging data (e.g., CADD/GIS Technology Center, OGC, W3C)

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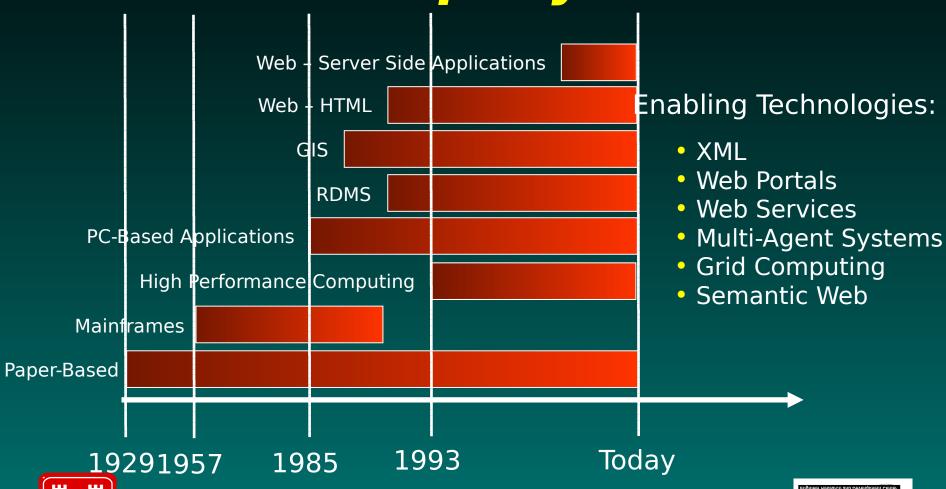
Technology Transfer Methodologies Are Changing Rapidly

Web – Server Side Applications

Web – HTML

GIS

RDMS

PC-Based Applications

High Performance Computing

Mainframes

Paper-Based

1929 1957   1985   1993   Today

Enabling Technologies:

- XML
- Web Portals
- Web Services
- Multi-Agent Systems
- Grid Computing
- Semantic Web

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Our Vision – A Web Centric S&E Framework

- Science and Engineering capabilities delivered over the Web
- This requires:
  - Consistent application of Web and interoperability standards
  - Common approach to information assurance
  - Dependable/secure operational environment capable of hosting our "Corporate Web Services"
  - Consistent and practical use of COTS software

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Capabilities

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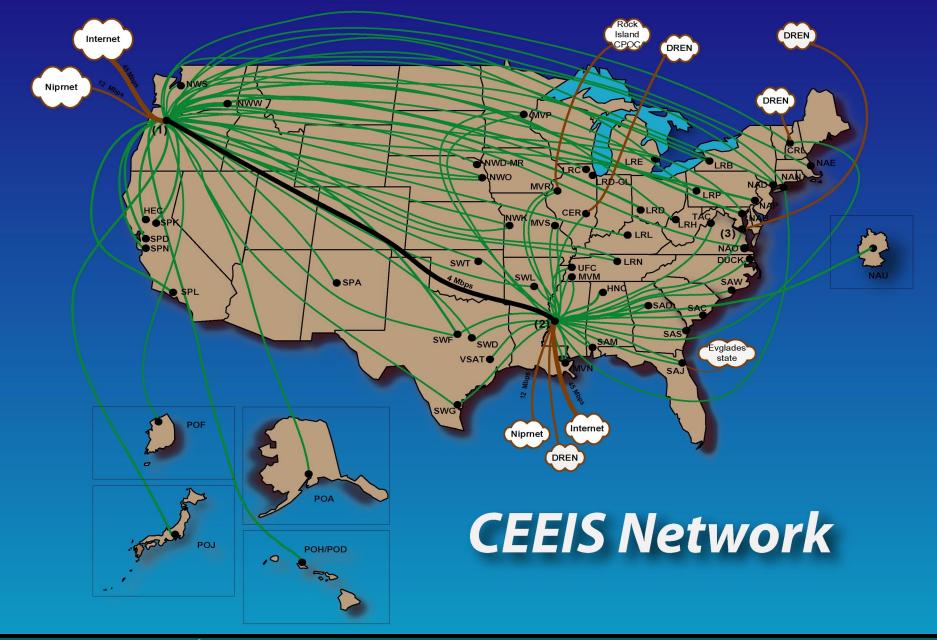
Communications and Computing Infrastructure

- High-speed computing and network connectivity

- Enterprise computing (business and scientific)

- Networking (LANS, WANS, wireless

CEEIS Network

A World-Class Computational Environment To Address Our Greatest Challenges

DoD Major Shared Resource Center

- Critical element in USACE's suite of technologies

- Enhanced numerical modeling capabilities

- Complements large experimental facilities

- Ensures USACE maintains frontier capabilities in computational science, computing, networking, and scientific visualization

Defense Research and Engineering Network

(DREN)

- **Provides digital, imaging, video, and audio data transfer services between defined service delivery points**

- **Supports bandwidths from 45 Mbps at user sites up to 622 Mbps at selected HPC sites**

- **Enables 4,300+ scientists and engineers to use HPCMP computing resources**

- **On-line storage capability - 400+ trillion characters**

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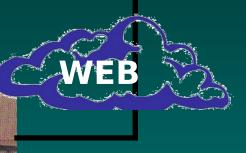
Making HPC Easily Accessible to Users

HPC Systems

ezHPC: Provides a Windows interface that simplifies access to HPC resources.

Window desktop environment:
- Access to Web resources
- GIS tools
- Decision support tools
- Data analysis tools
- Visualization

WEB

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Communications and Computing Infrastructure

Joint Computing Facility

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Communications and Computing Infrastructure

24 x 7 x 365 *Continuous Operations*

Uninterruptible Power Supply

UPS Generator Systems
Electrical/Power Systems
Heating-Ventilation-Cooling
Humidity Control

Access Control Systems
Raised Floor Loadings
Cabling Systems
Space Management

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Communications and Computing Infrastructure

Web Farm – a Common Hosting Environment

Using the Power of the World Wide Web to Deliver Technology

Web Pages and Applications

OS Web Server	Application Server	Database Server
Web	Application	Database
Internet	Intranet	Extranet
DREN		CEEIS

System Administration • Database System Administration • Help Desk
Information Assurance Support • Network Support
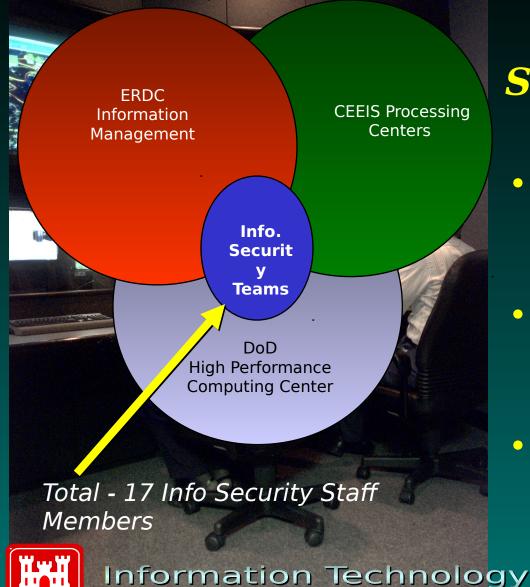
Web Application Development and Production Support

SECURITY

- 24 x 365 operation

- Continuous power, battery, and generator backup

- Internet, Intranet, and Extranet Web sites and applications

- Development, staging, production, COOP, and reverse proxy servers

- Web servers, application servers, and database servers

- Army-certified UNIX, NT, and Oracle system administrators, database administrators, and information assurance specialists

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Information Assurance

ERDC
Information
Management

CEEIS Processing
Centers

Info. Security Teams

DoD
High Performance
Computing Center

Total - 17 Info Security Staff Members

Information Security Teams for DoD, Corps, and ERDC

- Manage ERDC's IA program development

- Oversee network and systems security posture

- Ensure compliance with DoD, Army, and USACE regulations and guidance

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Security Is Key to a Network Centric Environment
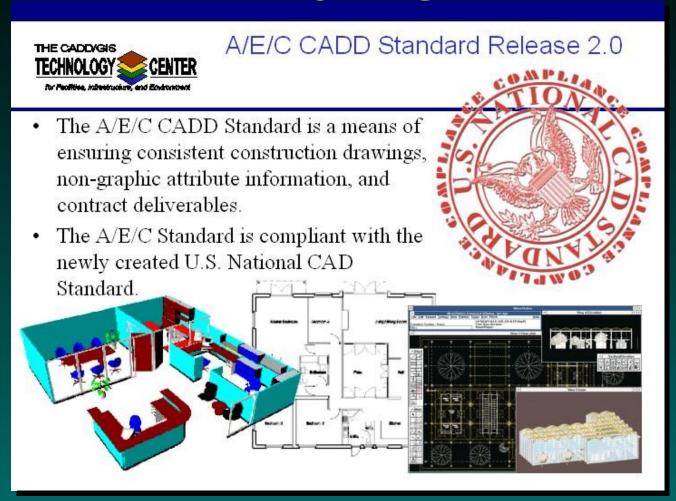
- Employ multiple intrusion detection systems (IDS), joint intrusion detection systems (JIDS)
- Maintain router-based access control lists
- VPN gateway to support wireless networks
- Scan network for security posture and new networked systems

- Initiate automation of IAVA distribution / response capability
- Certification / accreditation of network and systems
- Database of all networked systems
- Network traffic data warehouse via NetDetector
- Investigate IDS in IPv6 for DREN and DoD
- Implement automatic virus detection software updates at desktops
- Investigate new security tools, techniques, practices, and technology

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CADD/GIS Technology Center for Facilities, Infrastructure, and Environment

A/E/C CADD Standard Release 2.0

THE CADD/GIS
TECHNOLOGY **CENTER**
for Facilities, Infrastructure, and Environment

- The A/E/C CADD Standard is a means of ensuring consistent construction drawings, non-graphic attribute information, and contract deliverables.

- The A/E/C Standard is compliant with the newly created U.S. National CAD Standard.

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Facility Management

- Published first release of
  transactional FMSFIE
  (FMSFIE Release 2.30) in
  Sept 03

- Expanded the Federal Real
  Property Management
  Database and Web site to
  include 1,173 Federal

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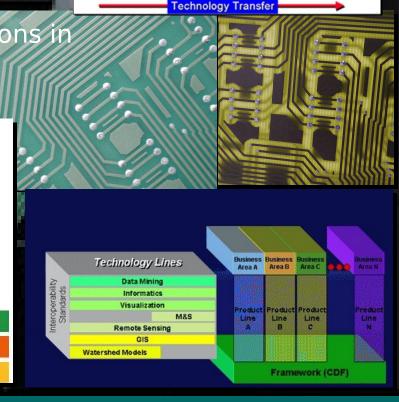
Technology Delivery Architectures

- Common, Web-enabled computational framework that provides an interoperable computing and technology delivery environment for science and technology products

- Examples of Web or network applications in Common Delivery Framework:
    - Authentication
    - Document indexing
    - Search tools
    - Web development tools
    - Database tools
    - Computational resource tools
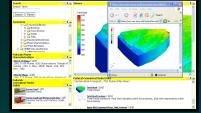
Common Delivery Framework (CDF)

5 **and more . . .**

- A managed set of corporate assets (guidance, software, catalogues, data linkages, metadata, etc.) that enables information and technology delivery
- More specifically, CDF provides guidance, capabilities, and services that . . .

4 **support the delivery of S&E information via Web portals**

3 **standardize multidimensional model data**
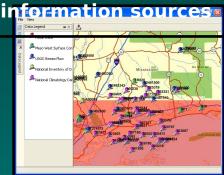
1 **simplify access to computational resources**

2 **assemble S&E data from disparate heterogeneous information sources**

Computational Codes

XMDF

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One Data World – The DataNet

- The DataNet is a Web-centric framework for sharing/integrating distributed heterogeneous data resources

  – One-stop-shop for S&E data

  – Search for data from sources inside and outside the "corporate walls"

  – Presents information on services in a single browser-based view

USACE

Gov't Partners

Industry

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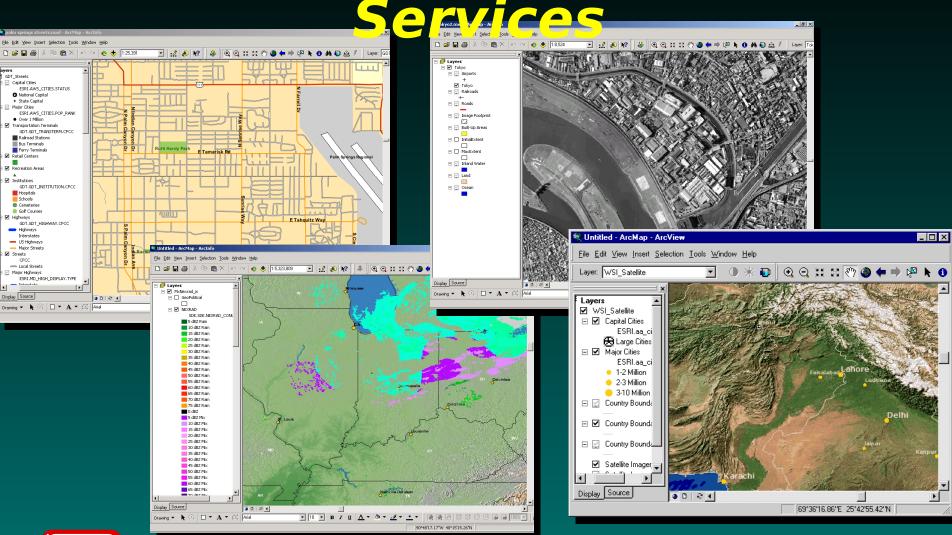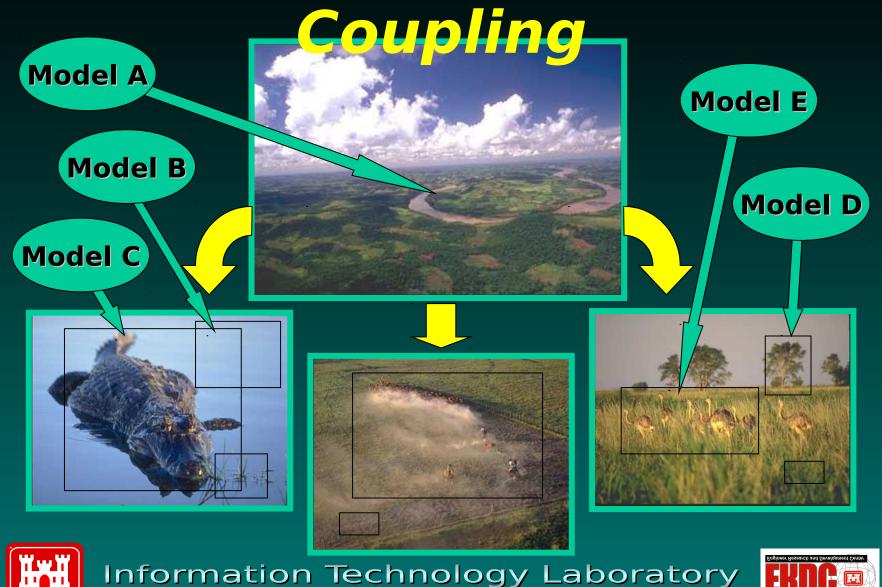
Connecting to Commercial Data Providers - ArcWeb Map Services

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Computational Frameworks for Model Coupling

Model A

Model B

Model C

Model E

Model D

Provide a Standard for Numerical Model Data
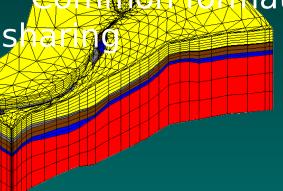
eXtensible Model Data Format (XMDF
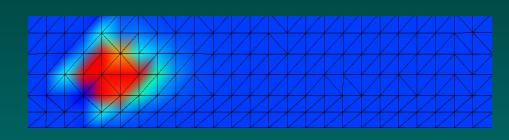
- Provides a common modeling format that facilitates
  data storage, exchange, access, analysis, and
  discovery of scientific and engineering data
- Common format allows common tools and
  sharing
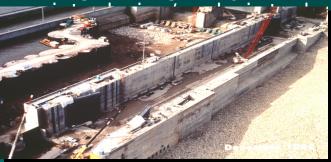
Computer-Aided Structural Engineering (CASE)

- Problem
  - Need exists for an organized, cost-effective approach for development of computer tools for Corps designers
  - Need exists for automated analysis/design tools that incorporate current Corps criteria
  - Need exists for specialized R&D studies required to provide the transition of complex numerical engineering analysis methods into design/analysis tools

- Objective/Product
  - Perform R&D necessary to develop/adapt computer tools for use in the design/ analysis of Corps unique structures
  - Develop/enhance numerical models and procedures to provide efficient, innovative design/analysis tools
  - Products are a set of well-defined, well-tested, reliable numerical models and procedures

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Panama Canal – 3ʳᵈ Lane

Mark Smith
The Panama Canal

3-D interactive model of Mira Flores and Pedro Miguel locks for design engineering.

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Computer-Aided Modeling of Portugues Dam

Portugues Dam

The U.S. Army
Corps of Engineers
Arch Dam

Ponce, Puerto Rico

Byron Foster
The Portugues Dam

Conceptual visualization of design of 3-centered,
double curved arch dam for Ponce, Puerto Rico.

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Risk Analysis for Dam Safety

- Developed frameworks for site-specific and portfolio risk assessments
- Tested/validated frameworks through demonstration projects
- Developed procedures for incorporating loss of life into risk assessment model
- Fragility failure model for concrete gravity dams
- Simple probabilistic model for breaching at embankment dams
- Preliminary risk analysis model for unlined spillway erosion to be validated on portfolio demonstration
- Assessment of geology as it pertains to jointed rock for incorporation into JOINT- FLOW model
- Stochastic precipitation-runoff model

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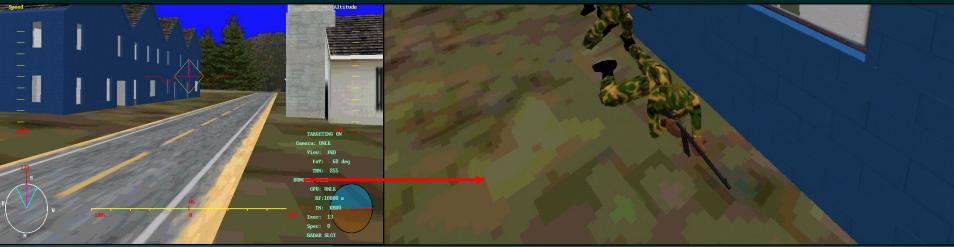
Real world to interactive simulation in 72 hours

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Computational Science and Engineering
Automated Route Reconnaissance Kit

Recon:Control

Seek
- < x 8 >
- Sound
- Current Location
- 42 S W C 21117 24579
- Segment Distance (km) 12.40
- Distance

UNCLASSIFIED

System mounted in a HMMWV

Video collected using the ARRK

42 S W C 21109 24591

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Intelligent Facilities To Counter Asymmetric Threats

Description:

- Improvements in threat protection can be accomplished by employing an intelligent sensor web for monitoring security, structural integrity, and operations
- This approach collectively employs acoustic, radio frequency, motion, chemical, and other existing sensors to improve the detection of activities considered a threat to a facility

- Distributed Sensors
  - In-node processing and communications capability
  - Heterogeneous sensor types and modalities
- Software Agents
  - Information sharing
  - Hypothesis formation and management
  - Autonomous and cooperative behaviors

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Professional and Informative Use of the Web

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On-Line Knowledge Center (OKC)

OKCs are Web portals that access distributed heterogeneous resources connected to CDF

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Focusing on Integration and Innovation in Support of Our Customers

Search

> Who We Are
» General Information
» Organization
» Contacts

> Centers
» DoD High Performance Computing Center
» CADD/GIS Technology Center for Facilities, Infrastructure, and Environment
» U.S. Army Corps of Engineers Enterprise Infrastructure Services

> Divisions
» Engineering and Informatic Systems Division
» Infostructure and Knowledge Management Division

> Ongoing Efforts
» Computer-Aided Structural Engineering

> What We Do
» Our Technology Focus Areas
- High Performance Computing
- Numerical Modeling
- Computer-Aided Engineering
- Technology Architectures
- Middleware
- Communications Architecture
- Information Assurance
- Measurement Systems
- Software Engineering
- Intelligent Systems
- Knowledge Management
- Technology Transfer
- Testing and Evaluation

> Products
» Patents
» Publications
» Software
» Standards

> Resources

> Highlights
New Systems Boost HPC Capabilities

Cray X1

SGI Origin 3900

GIS Spatial Data Standard Adopted as a National Standard

High-Resolution Acoustic Imaging System

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http://itl.erdc.usace.army.mil/